What is claimed is:

1. A quality monitoring method of wavelength division multiplexed signal light, for monitoring the quality of a wavelength division multiplexed signal light transmitted via an optical transmission path, comprising:

branching a part of the wavelength division multiplexed signal light being propagated through said optical transmission path as a monitor light;

selecting, as an object to be measured, a signal light of one wavelength from the signal lights of a plurality of wavelengths contained in said branched monitor light;

repeatedly measuring for a plurality of times the frequency of occurrences of bit error in a previously set time for said selected signal light to be measured;

judging based on said measurement results as to whether or not said signal light to be measured is deteriorated in the quality thereof, together with a deterioration factor; and

outputting said judgment result as monitoring information.

2. A quality monitoring method of wavelength division multiplexed signal light according to claim 1, further comprising:

generating a control signal for adjusting the power of said signal light to be measured according to said monitoring information; and

transmitting said control signal to the optical transmission path.

3. A quality monitoring method of wavelength division multiplexed signal light according to claim 1,

wherein the judgment as to whether or not said signal light to be measured is deteriorated in the quality thereof is performed based on a maximum value in the frequency of occurrences of bit error repeatedly measured for the plurality of times.

4. A quality monitoring method of wavelength division multiplexed signal light according to claim 1,

wherein, when it is judged that said signal light to be measured is deteriorated in the quality thereof, it is judged whether or not signal lights exist on wavelength grids adjacent to said signal light to be measured, and when the signal lights exist on the adjacent wavelength grids, the frequency of occurrences

of bit error in the previously set time is repeatedly measured for the plurality of times for the signal lights on the adjacent grids, and the deterioration factor of said signal light to be measured is judged based on said measurement results.

5. A quality monitoring method of wavelength division multiplexed signal light according to claim 4,

wherein the judgment of the deterioration factor of said signal light to be measured is performed based on the uniformity of time-wise distribution of the frequency of occurrences of bit error for said signal lights on the adjacent grids.

6. A quality monitoring method of wavelength division multiplexed signal light according to claim 5,

wherein, when the time-wise distribution of the frequency of occurrences of bit error for said signal lights on the adjacent grids is more uniform than a previously set state, it is judged that said signal light to be measured is deteriorated due to a noise light generated in an optical amplifier disposed on said optical transmission path being a main factor, while when the time-wise distribution of the frequency of occurrences of bit error for said signal lights on the adjacent grids is less uniform than said previously set state, it is judged that said signal light to be measured is deteriorated due to a non-linear effect being a main factor.

7. A quality monitoring method of wavelength division multiplexed signal light according to claim 6, further comprising:

generating a control signal for increasing the power of said signal light to be measured, when it is judged that the main factor of the deterioration of said signal light to be measured is the noise light generated in the optical amplifier; and

generating a control signal for reducing the power of said signal light to be measured, when it is judged that the main factor of the deterioration of said signal light to be measured is the non-linear effect.

8. A quality monitoring apparatus of wavelength division multiplexed signal light, for monitoring the quality of a wavelength division multiplexed signal light transmitted via an optical transmission path, comprising:

an optical branching section that branches a part of the wavelength

division multiplexed signal light being propagated through said optical transmission path as a monitor light;

a wavelength selecting section that selects, as an object to be measured, a signal light of one wavelength from the signal lights of a plurality of wavelengths contained in said branched monitor light;

a bit error measuring section that repeatedly measures for a plurality of times the frequency of occurrences of bit error in a previously set time for said selected signal light to be measured;

a switching control section that generates a switching signal for controlling an operation of said wavelength selecting section according to measurement results in said bit error measuring section; and

a deterioration factor judging section that judges based on said measurement results in said bit error measuring section as to whether or not said signal light to be measured is deteriorated in the quality thereof, together with a deterioration factor, and outputs said judgment result as monitoring information.

9. A quality monitoring apparatus of wavelength division multiplexed signal light according to claim 8, further comprising:

a control signal generating section that generates a control signal for adjusting the power of said signal light to be measured according to said monitoring information output from said deterioration factor judging section; and

an optical multiplexing section that transmits said control signal generated in said control signal generating section to the optical transmission path.

10. A quality monitoring apparatus of wavelength division multiplexed signal light according to claim 8,

wherein said deterioration factor judging section judges whether or not said signal light to be measured is deteriorated in the quality thereof based on a maximum value in the frequency of occurrences of bit error repeatedly measured for the plurality of times in said bit error measuring section.

11. A quality monitoring apparatus of wavelength division multiplexed signal light according to claim 8,

wherein said deterioration factor judging section, when judged that said signal light to be measured is deteriorated in the quality thereof, judges whether or not signal lights exist on wavelength grids adjacent to said signal light to be

measured, and when the signal lights exist on the adjacent wavelength grids, repeatedly measures for the plurality of times the frequency of occurrences of bit error in the previously set time for the signal lights on the adjacent grids, and judges the deterioration factor of said signal light to be measured based on said measurement results.

12. A quality monitoring apparatus of wavelength division multiplexed signal light according to claim 11,

wherein said deterioration factor judging section judges the deterioration factor of said signal light to be measured based on the uniformity of time-wise distribution of the frequency of occurrences of bit error for said signal lights on the adjacent grids measured in said bit error measuring section.

13. A quality monitoring apparatus of wavelength division multiplexed signal light according to claim 12,

wherein said deterioration factor judging section, when the time-wise distribution of the frequency of occurrences of bit error for said signal lights on the adjacent grids is more uniform than a previously set state, judges that said signal light to be measured is deteriorated due to a noise light generated in an optical amplifier disposed on said optical transmission path being a main factor, while when the time-wise distribution of the frequency of occurrences of bit error for said signal lights on the adjacent grids is less uniform than said previously set state, judges that said signal light to be measured is deteriorated due to a non-linear effect being a main factor.

14. A quality monitoring apparatus of wavelength division multiplexed signal light according to claim 13, further comprising:

a control signal generating section that generates a control signal for increasing the power of said signal light to be measured, when it is judged in said deterioration factor judging section that the main factor of the deterioration of said signal light to be measured is the noise light generated in the optical amplifier, and generates a control signal for reducing the power of said signal light to be measured, when it is judged in said deterioration factor judging section that the main factor of the deterioration of said signal light to be measured is the non-linear effect; and

an optical multiplexing section that transmits the control signals generated

in said control signal generating section to the optical transmission path.

15. A quality monitoring apparatus of wavelength division multiplexed signal light according to claim 8,

wherein when the wavelength division multiplexed signal light transmitted over said optical transmission path contains signal lights of different bit rates,

said wavelength selecting section includes an optical branching device for branching a signal light to be measured selected by said wavelength selecting section into a plurality of lights according to types of bit rates of the signal lights contained in the wavelength-division multiplexed signal light, and a plurality of optical receivers corresponding to the bit rates of the signal lights, and the lights branched by said optical branching device are given to said optical receivers.

16. A quality monitoring apparatus of wavelength division multiplexed signal light according to claim 8,

wherein said optical branching section includes a plurality of optical branching devices for branching parts of the wavelength division multiplexed signal lights being propagated through a plurality of optical transmission paths as monitor lights, and any one of the monitor lights branched by said optical branching devices is switched in time-wise to be given to said wavelength selecting section, thereby the qualities of the wavelength division multiplexed signal lights being propagated through said plurality of optical transmission paths being monitored by time-division.

17. A quality monitoring apparatus of wavelength division multiplexed signal light according to claim 8,

wherein said optical branching section includes an optical branching device capable to branch parts of the wavelength division multiplexed signal lights being propagated in bi-directions through the optical transmission path as monitor lights, and one of the monitor lights corresponding to propagation directions branched by said optical branching device is switched in time-wise to be given to said wavelength selecting section, thereby the qualities of the wavelength division multiplexed signal lights being propagated in bi-directions through said plurality of optical transmission path being monitored by time-division.

18. An optical transmission system in which a wavelength division multiplexed

signal light is transmitted between an optical transmission section and an optical reception section via an optical transmission path and one or more repeater node disposed on said optical transmission path,

wherein at least one of said optical transmission section and said repeater node is provided with a quality monitoring apparatus of wavelength division multiplexed signal light in claim 8.

19. An optical transmission system according to claim 18,

wherein parts of a plurality of repeater nodes disposed on said optical transmission path are provided with apparatuses for monitoring the quality based on measurement of the optical spectrum of the wavelength division multiplexed signal light.